

Abstract

Field experiments were conducted to measure subsurface movement and volatilization of the Telone® (1,3-dichloropropene, 1,3-D alone or with chloropicrin) after shank injection into agricultural soil.

The goal of this study was to evaluate the effectiveness of several emission-reduction methods, including: sprinkler irrigation, organic amendment, deep injection, and fertilizer amendment on the volatilization of 1,3-D, alone or with chloropicrin, to the atmosphere.

Several methods were used to estimate fumigant volatilization rates and total emission losses, including: aerodynamic, integrated horizontal flux, theoretical profile shape, and back-calculation methods. These methods provide estimates of the volatilization rate based on measurements of wind speed, temperature and 1,3-D concentration in the atmosphere.

During the 2005 experiment, the volatilization rate was measured continuously for 16 days and the daily peak volatilization rates ranged from $18\text{--}60 \mu\text{g m}^{-2} \text{s}^{-1}$ (10–15% of applied Telone II) for the irrigated field and $4\text{--}23 \mu\text{g m}^{-2} \text{s}^{-1}$ (3–8% of applied Telone II) for the field amended with organic matter.

During the 2007 experiment, the volatilization rates ranged from $12\text{--}30 \mu\text{g m}^{-2} \text{s}^{-1}$ (11–23% of applied Telone C-35) for the standard fumigation; $13\text{--}34 \mu\text{g m}^{-2} \text{s}^{-1}$ (10–17% of applied Telone C-35) for deep injection fumigation; and $7\text{--}20 \mu\text{g m}^{-2} \text{s}^{-1}$ (9–18% of applied Telone C-35) for a field amended with ammonium thiosulfate. For all fields, very low (i.e. <2%) emissions of chloropicrin were observed.

Intermittent irrigation reduced total emissions by 45–70% and adding composted municipal green waste reduced total emissions by 80–85% compared to conventional fumigant applications. For deep injection and spraying the surface with ammonium thiosulfate (ATS) only a 20% reduction in emissions was observed.

Significant reduction in volatilization of 1,3-D was observed for the irrigation and organic matter treatments, but smaller reduction in emissions were observed for deep injection and ATS amendment in a surface spray (i.e., without surface irrigation).